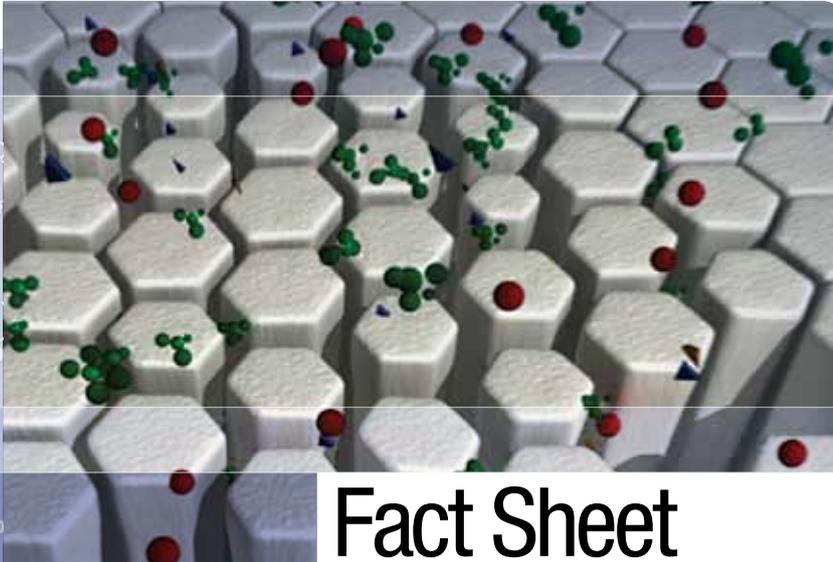


Tri-Calcium Phosphate (TCP)

A calcium technology exclusively from 3M ESPE



Fact Sheet

Innovative tri-calcium phosphate

- Close in composition to natural tooth mineral
- Defined and stable structure
- Predictable chemical properties
- Optimised to release calcium and phosphate at the tooth surface
- Protected calcium does not react with fluoride in tooth creme or varnish formulations during storage

Introduction

Although caries continues to be the most prevalent dental disease worldwide, significant reductions in dental caries have been reported over the past 30 years. The decline is attributed to nearly universal use of products containing fluoride, such as tooth cremes and oral rinses, as well as professionally applied compounds containing higher concentrations of fluoride.

Fluoride is proven to prevent tooth decay. It does so by inhibiting demineralisation, enhancing remineralisation, and inhibiting bacterial activity in dental plaque. In recent years, we've advanced our understanding of the roles calcium and phosphate also play in remineralizing tooth cremes and other dental products.

Clinical trials have shown that applying products with high concentrations of both calcium and

fluoride may not result in greater protection against tooth decay.¹ That's because the calcium and fluoride can combine during storage to form calcium fluoride—which renders the fluoride less effective in preventing tooth decay.

However, 3M ESPE has introduced a proprietary calcium phosphate ingredient, Tri-Calcium Phosphate (TCP), that can be protected from unwanted interactions with fluoride during storage. This protected calcium additive works with fluoride to initiate high-quality mineral growth—acting as a catalyst to enhance remineralisation and build a high-quality, acid-resistant mineral.²

A New Approach: Tri-Calcium Phosphate (TCP)

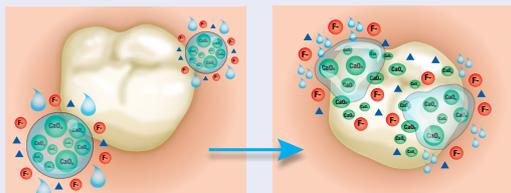
Functionalised tri-calcium phosphate, or TCP, is a “smart” calcium phosphate system that controls the delivery of calcium and phosphate ions to the teeth, works synergistically with fluoride to improve performance, but does not result in unwanted interactions with fluoride during product storage.

TCP is a partially soluble precursor to hydroxyapatite, the principle mineral of teeth, and is specially prepared so it can co-exist with fluoride in both aqueous or non-aqueous product formats.

Designed for a specific fluoride vehicle (e.g., dentifrice or varnish), TCP is milled with simple organic materials to create a functionalised TCP ingredient. This process ensures that prior to use, the active calcium sites are protected from premature interactions with fluoride, which could otherwise render both calcium and fluoride inactive.

Since the structure of TCP is similar to hydroxyapatite, once the functionalised calcium ions are released, they readily interact with the tooth surface and subsurface. While other calcium phosphate additives may require an acidic pH, which could limit the benefits to the tooth, functionalised TCP can offer optimal benefits when delivered in a neutral pH environment.

As functionalised TCP is less soluble relative to other forms of calcium phosphate³, when applied as a dentifrice in formulation with fluoride, this TCP ingredient can enhance mineralisation and help build a high-quality, acid-resistant mineral—without the need for high levels of calcium.



Organic components (often surfactants) have an affinity for tooth surfaces—and can carry calcium to the tooth surface, protected from fluoride ions. Saliva activates the protected calcium compound by degrading the protective coating and releasing the calcium, making it available to the tooth surface along with the fluoride.

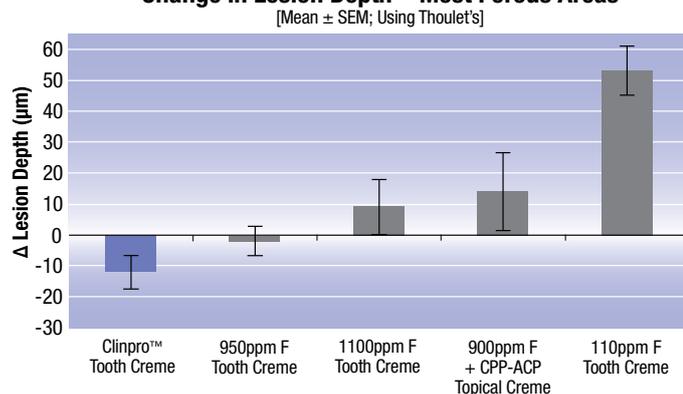
Clinical Applications: Clinpro Tooth Creme

As the functionalised (TCP) ingredient is protected from unwanted interactions with fluoride within the tooth creme during storage, it remains stable and allows for more fluoride availability. During brushing, both fluoride and the TCP ingredient are delivered to the tooth and provide enhanced remineralisation and added protection against demineralisation. Several laboratory studies have proven superior performance when the TCP material is added to fluoride tooth cremes at optimal concentration.

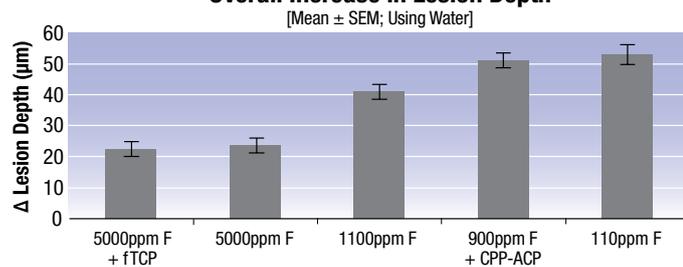
Reduces lesion depth⁵

The purpose of this study was to evaluate the de/remineralisation effect on enamel lesions after treatment with products containing fluoride, using a pH-cycling model in vitro. Human enamel samples were demineralized to create enamel lesions and then divided into treatment groups. The daily pH-cycling period consisted of a 2-minute treatment twice a day with product, followed by periods of demineralisation and artificial saliva over a 14-day period. Samples were evaluated using Polarized Light Microscopy analysis.

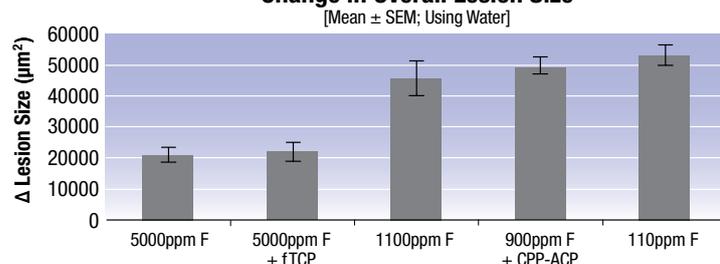
Change in Lesion Depth—Most Porous Areas



Overall Increase in Lesion Depth



Change in Overall Lesion Size

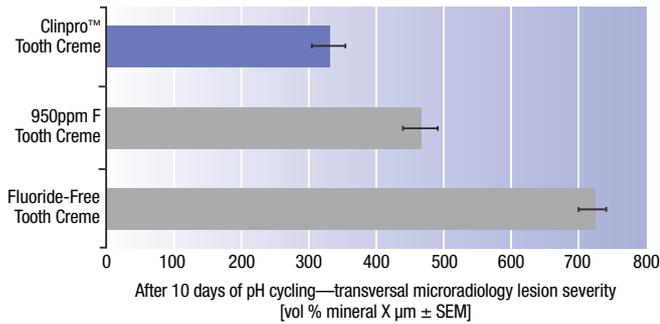


Conclusion: Clinpro™ Tooth Creme reduced the average lesion depth by more than 10%, demonstrating remineralisation was occurring deep in the lesion with the most severe damage.

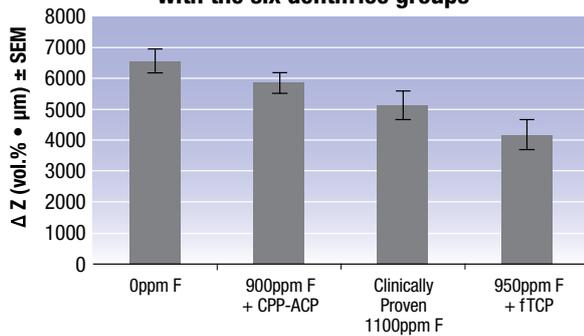
Repairs early lesions⁶

The purpose of this study was to evaluate how well different tooth creme formulations enhance remineralisation of existing white spots. In the study design, white spot lesions on bovine enamel samples were subjected to periods of demineralisation, remineralisation and tooth creme treatments. After cycling the lesions for 10 days, lesions were evaluated.

Reduces Lesion Size



Size of Lesion (ΔZ) after 10-day Cycling Regimen with the six dentifrice groups



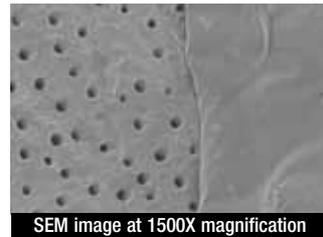
Conclusion: Results indicate that Clinpro Tooth Creme provides superior remineralisation at both the enamel surface and deep within the lesion.

Clinical Applications Fluoride Varnish

Decreases hypersensitivity

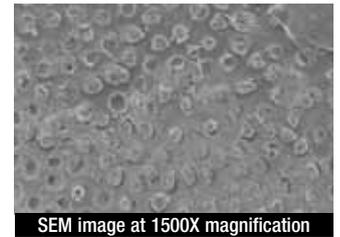
Tri-calcium phosphate, when added to Clinpro™ White Varnish, can help decrease hypersensitivity by depositing high-quality, acid-resistant mineral that occludes exposed dentinal tubules.

Clinpro white varnish coats, penetrates and blocks tubules.



Clinpro™ White Varnish covers and occludes open tubules for immediate relief.

Source: 3M ESPE internal data



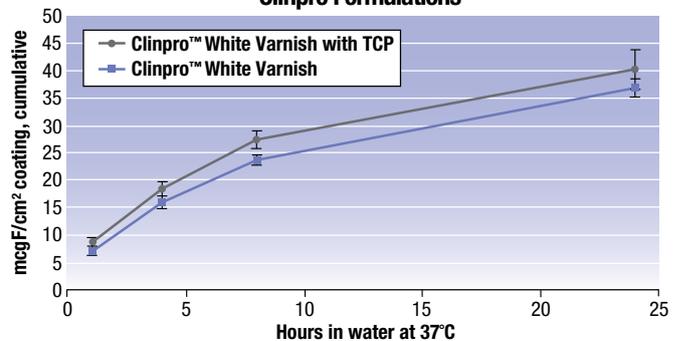
After the bulk of the varnish has been removed from the surface, Clinpro™ White Varnish continues to block tubule openings.

Source: 3M ESPE internal data

Sustains fluoride availability^{7,8}

In a laboratory study done with fluoride varnishes, Clinpro white varnish was tested before and after addition of functionalised TCP.

Cumulative Fluoride Ion Release Data Clinpro Formulations



Conclusion: Results showed that addition of this novel TCP ingredient to Clinpro white varnish does not inhibit fluoride availability.

Results of a related clinical study done with Clinpro white varnish showed no significant differences in mean fluoride salivary levels before and after addition of functionalised TCP for at least 4 hours after application.

Preventive products with calcium-based technologies exclusively from 3M ESPE

3M ESPE's exclusive TCP ingredient is the latest advancement in preventive care. This breakthrough technology has been added to our anti-cavity tooth creme and fluoride varnish treatment, raising effectiveness in enhancing remineralisation, preventing demineralisation of tooth structure, or decreasing tooth hypersensitivity.



Clinpro™ Tooth Crème

- Prevents demineralisation and enhances remineralisation of tooth structure



Clinpro™ White Varnish with TCP

- Decreases tooth hypersensitivity

Summary

For the clinician prescribing a treatment plan to prevent tooth decay or tooth hypersensitivity, products with 3M ESPE's exclusive TCP ingredient would be highly recommended. Results of third-party comparative studies **suggest the TCP ingredient may provide added protection above fluoride alone**. TCP is a proprietary ingredient in both Clinpro Tooth Crème Anti-Cavity Toothpaste and Clinpro White Varnish with TCP.

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